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THE APPLE AND HOW TO GROW IT.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF POMOLOGY,
Washington, D. C., January 15, 1900.

SIR: I have the honor to transmit herewith, for approval and publication as a Farmers' Bulletin, an article on The Apple and How to Grow it. It embraces topics intended especially for the guidance of the farmer in the propagation, cultivation, and care of the family orchard, and not for the commercial orchardist. If, however, the farmer should wish to consider the commercial side of the question, he will find within these pages the needed information for the enlargement of his orchard so as to include market varieties.

No reference is made to insects or diseases affecting the apple, the limits of a Farmers' Bulletin not permitting such enlargement as this would evolve.

Respectfully,

G. B. BRACKETT,
Pomologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

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THE APPLE AND HOW TO GROW IT.

INTRODUCTION.

Every farmer, however small his possessions may be, who lives within the apple-growing districts of the United States should have an apple orchard, the product of which should be found on his table in some form every day of the year. It is the purpose of this bulletin to present briefly some of the reasons why the farmers of this country should give more attention to the planting and care of their orchards; to aid them in the selection of orchard sites, of the varieties they may profitably plant, and of the trees that will prove most thrifty and productive; and to give information as to after care of orchards and the best use and disposition to be made of the fruit when grown and ready for family use or market. If this should stimulate the apple industry among our farmers, although it be only for home use, it will be a sufficient reward for the preparation and publication of this treatise.

The possible range of apple growing within the territory of the United States is very great. Perhaps two-thirds of the settled portion of our country is more or less adapted to the growth of this staple fruit, and within that range there are but few cases where the farmer is excusable if he allows his family to go hungry for apples.

HISTORICAL NOTES.

Although the apple (*Pyrus malus*) is not a native of American soil, it seems to find a congenial home here. It is true we have some nearly related species in our native crabs, and they give promise in the hands of the experimenter of better things in the years to come, but as yet no specially valuable varieties have been developed from this source. Our cultivated apples and crabs are the lineal descendants of the wild crabs of Europe, *Pyrus malus* and *Pyrus baccata*, which have had many years of careful culture bestowed upon them to bring them to our present standard of excellence. When our American species have had as many years of domestic life and careful culture bestowed upon them they may rival their foreign cousins in many of their good qualities. In a short treatise like this, addressed as it is to the plain, practical farmers of our country, it may not be expected that an elaborate

scientific explanation of all the methods of improving and domesticating a wild species will be presented and discussed. It is deemed sufficient, therefore, under the present heading to say that the apple in its cultivated varieties as grown in this country is a foreigner, but, like the Caucasian race of man, has found a congenial home in the major portion of the United States and in large areas of the adjacent territory of British America.

USES OF THE APPLE.

So well known are the uses of the apple that little need be said upon this subject. No fruit known to the cultivator in the north temperate zone can take the place of the apple as a food product. Many other fruits, indeed most cultivated fruits, rank as luxuries, but the apple in most parts of the United States is one of the leading staple products of the farm.

In its numerous varieties its season of maturity extends throughout the year. No other fruit of the temperate zone may thus be had in continuous succession without resorting to artificial means of preservation. It is preeminently useful in the household economy. As a culinary fruit none excels it. It graces the table in a greater variety of forms than any other, and as a dessert fruit few are its equal and none its superior. Its juice when extracted makes an excellent and wholesome beverage, and for vinegar it has no rival. As a market fruit it is one of the easiest and least expensive to handle, and usually finds a ready market if well grown and handled with that end in view.

Among the many ways in which the apple is now used, the manufacture of jellies and preserves is one of growing importance. The numerous factories for the manufacture of these goods which have sprung up all over the apple-growing region of the country have not only created a demand for second and third grade apples, but also for the waste products—cores and skins—resulting from drying and evaporating the fruit. It has been found that jellies made from this apple waste is almost as good as those manufactured from whole fruit. These waste products have not only a value for the uses above mentioned, but there is a growing demand for them for export purposes for the manufacture of cheap wines and cider.

Chops, for which there is also ready sale for export purposes, are made from the lower-grade apples by chopping the whole fruit into coarse pieces and converting by an evaporator into what is known as chops.

Apple butter of the real, rich, old-time farm product, not the thin, factory-made excuse, fills an important place in the household economy and always finds a ready sale at good prices.

Good sweet cider made from sound apples, not from half-decayed,

wormy fruit, is one of the most healthful products of the orchard, and all surplus over and above what is needed for home consumption is always in demand at remunerative prices. It can be kept sweet and unfermented by heating it to a temperature of 160° F. and holding it there for thirty minutes, then sealing it up tight in bottles or casks, to be put into a cool place.

Boiled cider made in the good old-fashioned way by reducing to one-fifth by boiling, and canned, makes an excellent article for culinary purposes, for making apple butter, apple sauce, or for use in apple or mince pies. It also has a commercial value.

While the aim and purpose of the farmer should be to supply an abundance of fruit for his own family, he should also be able to offer to the outside world a liberal surplus. The apple orchard will often bring him better returns for his outlay than any other portion of his farm, acre for acre. The product of a single tree will sometimes sell for \$10 or more, and fifty such trees can be grown on an acre of land. Though we may not always count on such large results, we may safely expect the orchard to do its full duty one year with another, especially if we first do our duty by it.

PROPAGATION.

We would not recommend the average farmer to propagate his own trees for planting, but it is well enough for him to understand something of the processes and methods of propagation commonly practiced. The natural method of propagation is by planting the seed of the fruit, but as a very large per cent of seedlings are inferior in quality to the parent variety, the results are too uncertain to recommend for planters generally. Only the painstaking experimenter who wishes to originate new varieties can afford to practice this natural method of propagation.

Once having obtained a valuable variety and wishing to multiply and perpetuate it, one of several methods now in use must be resorted to for propagation. The methods more commonly practiced in growing young apple trees for planting in orchards are budding and grafting.

BUDDING.

With the apple this operation must be performed during the growing season, and consists in removing a bud from a twig of the variety which we wish to propagate and inserting it beneath the bark of the stock or young seedling tree we wish to change; and this is then held in place by tying it fast until the bud and the stock have united. Then by forcing the sap and consequent growth into this transplanted bud by preventing all other growth, we get a new tree of the desired variety. This we call budding. It is a method of artificially multiplying

a desirable variety. The extent of this multiplication is limited only by the number of buds available. A budding knife and the successive stages of budding are shown in fig. 1.

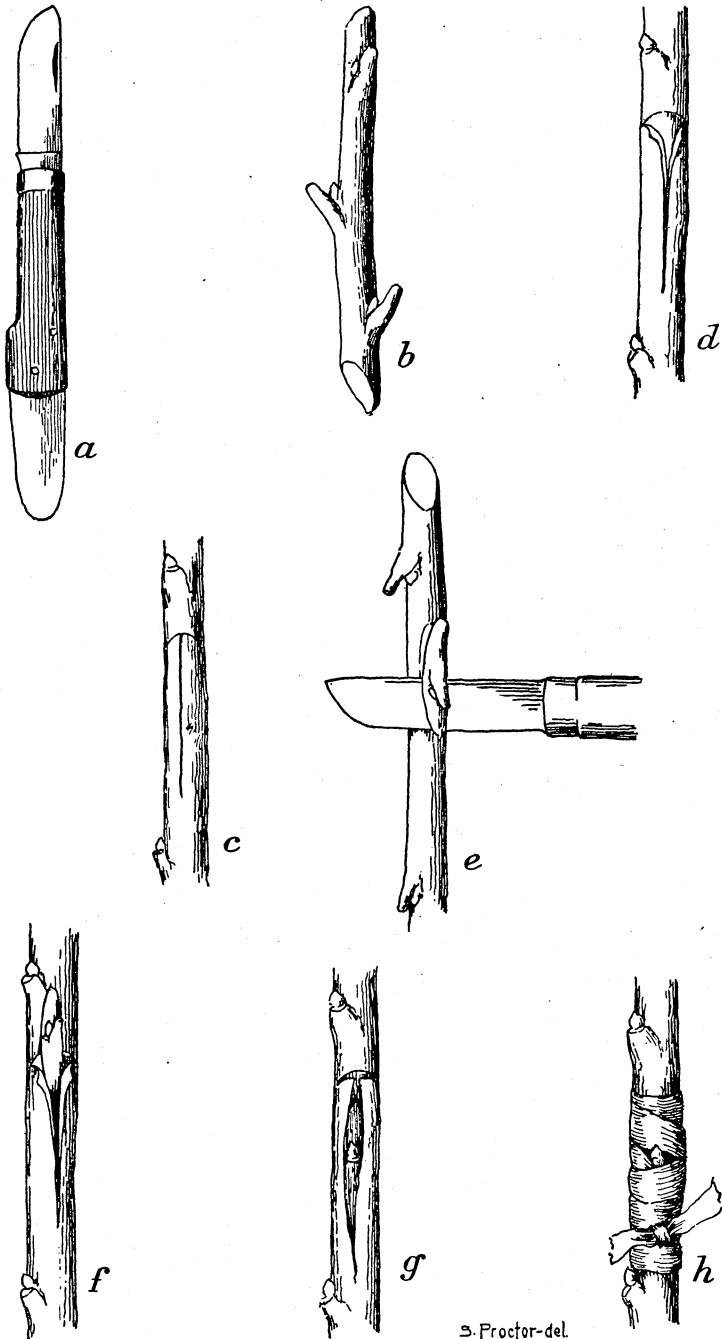
The main requisite for success in budding is a healthy, growing condition of the stock on which the work is to be done and a certain state of maturity of the buds. The bark of the stock must separate freely, so that the bud may be forced under it without injury to the cambium layer of either bud or stock. The bud sticks or scions selected for summer budding should be of the current year's growth and should have well-developed buds. When taken from the tree the leaves must be cut off immediately, leaving only a short stub of the leaf stem for convenience in handling during the operation. (Fig. 1, *b*). They should be kept in a fresh condition by use of damp moss or wet cloth until using, and not more than one or two scions should be withdrawn from the package at a time.

June budding.—If it is desired to start the bud into growth the same season it is inserted, the budding should be done as early in the season as well-developed buds can be obtained. As soon as it is found that the bud has united with the stock or branch, the material used to fasten the bud in place must be removed and the stock or branch cut back to within a short distance from the bud, to force the growth of the inserted bud.

Late fall budding.—This is the kind of budding more commonly practiced among nurserymen, the buds being inserted into the stock as late in the season as the bark of the stock will separate freely to receive it. In such instances the bud remains dormant through the following winter. The following spring the wrapping is removed and wherever the buds appear sound the tops of the stocks are cut back and treated in the same manner as described for June budding. All buds on the stocks below the one inserted should be rubbed off as they start to grow. The objection to early, or June, budding is that the growth from such buds does not always mature sufficiently in northern sections to pass a severely cold winter without injury.

GRAFTING.

Grafting, unlike budding, is usually performed during the dormant period of growth. It is performed by carefully fitting a small dormant twig or scion of the variety we wish to propagate into a cut in a stock or seedling tree which we wish to change. There are several forms of grafting, but they differ more in method than in results. In fact, so far as the top of the tree is concerned the results are the same in all cases whether we bud or graft. The object sought is to change an undesirable or uncertain tree into one which we know will produce a certain variety whose fruit will possess certain desirable characteristics.

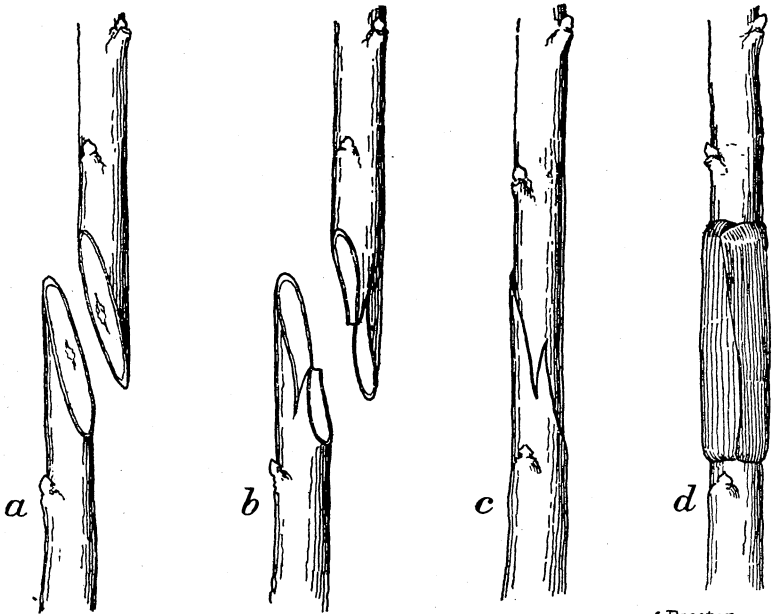


S. Proctor-del.

FIG. 1.—Budding: *a*, budding knife; *b*, bud stick; *c*, incision lengthwise with cross cut at top; *d*, opening of bark for insertion of bud; *e*, removing the bud; *f*, inserting the bud; *g*, bud inserted; *h*, tying in the bud.

Splice grafting.—This is a simple form and is used when the stock and scion are very nearly the same size. It consists in splicing or lapping the scion on the stock by scarfing each at the same angle. (Fig. 2, *a*.) When a close joint is secured the parts are held in place by means of some kind of wrapping material. (Fig. 2, *d*.)

Tongue grafting.—This form differs from splice grafting in that both scion and stock are split at corresponding points on the scarf with a thin-bladed knife so as to form tongues as represented in fig. 2, *b* and *c*. The object of this is to unite more firmly the two portions and present a larger surface for the effusion of cell tissue, and to promote the



J. Proctor

FIG. 2.—Successive steps of stock grafting: *a*, splice graft; *b*, tongue graft, separate parts; *c*, tongue graft, parts united; *d*, wax applied.

callusing process. This is the method commonly practiced by nurserymen under the name of root grafting.

Root grafting.—Thrifty 1-year-old stocks grown from seed are taken up in the fall and stored in a cellar or buried in the soil, where they will keep fresh and be accessible at any time in winter when wanted. The scions having been secured in the fall, the work of grafting may be performed at any time during the winter. The roots only are used in this method and they may be cut in two or more sections according to their size and length or the desire of the propagator. But the larger or stronger roots as a rule may be relied upon for the most satisfactory results.

In the foregoing methods of grafting, but especially in the first, the parts must be held together by some kind of bandage or tie. This may be made of thin cotton cloth or tough manila paper spread with melted grafting wax and when cool cut or torn in narrow strips of convenient width for wrapping, as described in formula No. 1 for grafting wax (p. 13). But the most common method now practiced is

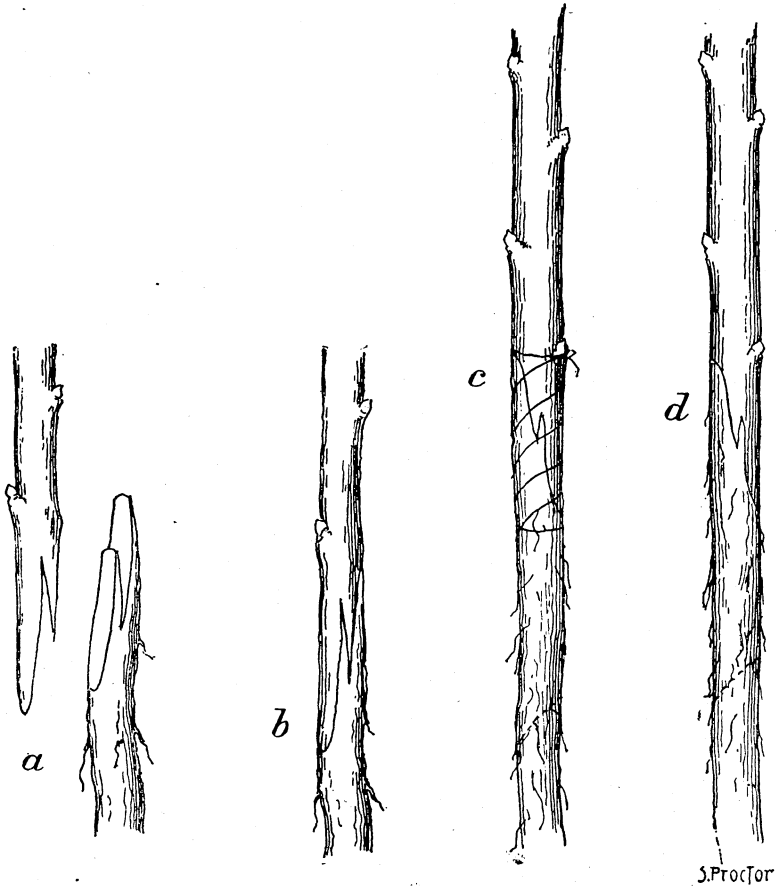


FIG. 3.—Root grafting; a, scion and root separate; b, scion and root united; c, scion and root united and tied; d, united scion and root with dotted line showing where root may be divided.

in using cotton yarn drawn through melted wax and wound upon a spool, from which it is used when wanted (fig. 3).

These root grafts, after having been tied in bundles, with each variety separately labeled, may be packed away in moist earth or loam and left in the cellar free from frost until spring, when they should be planted in nursery rows in the open ground and cultivated

for one, two, or three years, when they are ready to be transplanted to the orchard site.

Thorough cultivation in the nursery rows should be given, and some attention should be paid to training or shaping the young trees, so as to insure the best results when transplanted in the orchard.

Cleft grafting.—Cleft grafting is generally done when the stock is considerably larger than the scion and where the operation is to be performed above ground. The stock is split downward, after it has been cut off at the point where the scion is to be inserted, by using a fine-tooth saw. The bark should be cut through first to avoid being torn and so that the sides of the cleft will be smooth. A wedge is inserted to keep the cleft open for the insertion of the scion, which is cut wedge shape, with a long slope, one edge being a little thicker than the other (fig. 4). The object of this is to have the pressure

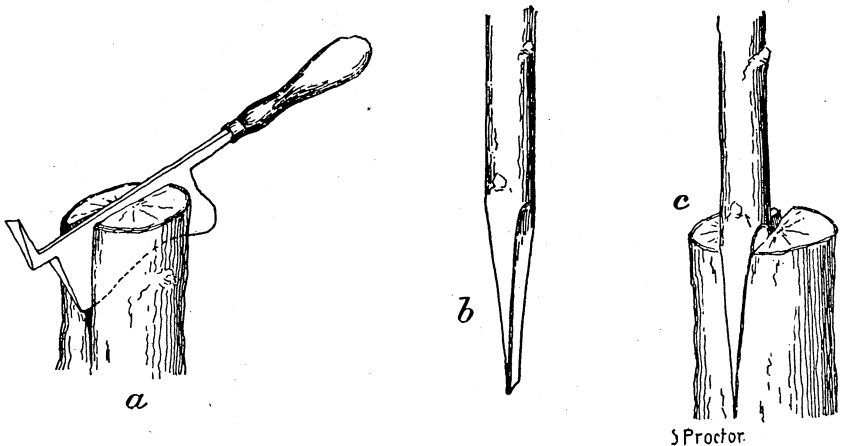


FIG. 4.—Cleft grafting; a, splitting the stock; b, scion prepared for insertion; c, scion inserted.

of the cleft greatest upon the outer side where the union is to be effected.

If the stock is large enough, a graft may be inserted on each side of the cleft, and if both grow one should eventually be cut off. After the scions have been properly inserted the wedge should be carefully withdrawn, leaving the scion in place, so that the inner bark of the scion and the stock shall coincide. If the pressure of the cleft be not sufficient to hold the scion in place, it must be wrapped with cloth or strings before waxing.

It is now ready for the grafting wax, which may be applied either in liquid form with a brush or in plastic condition after having been worked with the hands, or sometimes by wrapping with strips of muslin or manila paper previously spread with wax, as mentioned above. Great care should be taken to make every joint air-tight or the operation will be a failure.

REGRAFTING BEARING TREES.

This is sometimes very desirable when it is found after trees have come into bearing that the fruit is worthless. When the trees are not too old and are in a healthy condition the change can be made by regrafting with good results. But when the trees have attained a considerable age, and have lost their vitality to a considerable extent, it would be a waste of time and expense to attempt to change them; better plant new trees. If, however, in the case of healthy, vigorous trees, it is considered advisable to regraft tops, it is not best to do this all at one time. Only about one-third of the tree should be grafted the first year, selecting branches in the center and top of the tree. The next year another third may be grafted and the remainder the following year.

FORMULAS FOR GRAFTING WAX.

Formula No. 1, for outdoor work.—Resin 4 or 5 parts, beeswax $1\frac{1}{2}$ to 2 parts, linseed oil 1 to $1\frac{1}{2}$ parts. This is melted in a mass, and when cool enough it may be drawn out into thin strips and applied by wrapping it firmly around the stock where the scion is inserted, or a more convenient mode of using this wax is to spread it while melted upon thin muslin or strong manila paper and when cool cut or tear in strips of convenient width for wrapping around the grafted stock.

Formula No. 2, for indoor and outdoor work.—Resin 6 pounds, beeswax 1 pound, linseed oil 1 pint. Melt together, and when at the temperature of 180 degrees apply directly to the joints with a small bristle brush. In order to keep it at the proper consistency the vessel containing the wax may be placed in another vessel containing boiling water, which may be kept at this temperature by any convenient application of artificial heat.

LOCATING AN ORCHARD.

The selection of an orchard site is not governed by any arbitrary rule. All farms do not afford the best soils and exposures for orchards. The owners of such as do not are unfortunate, yet they should not feel discouraged to the extent of not planting trees and caring for them afterwards.

EXPOSURE.

Some kinds of soils and surface presentations are preferable to others, as they are better adapted to this fruit and require less expense in preparation and in the after care and treatment of the orchard. The most intelligent and experienced orchardists often differ as to the best location and exposure of an orchard, some preferring a northern slope, others an eastern, and yet others recommend a southern or even

a western as best. We think, however, that the advantages preponderate in favor of a gentle eastern or northeastern slope, as orchards located on such sites suffer less in both soil and tree from the effects of heat and drought. An orchard with such an exposure will maintain its vigor and longevity better than if inclined to the west or southwest. This is especially true in States south of the New England group, where the summers are long, hot, and dry, and where it is probable that the greatest injury to trees results from these causes. But, as stated above, all farms do not afford these most favorable sites, especially near the home, which is the most desirable location for the family orchard. Thus the planter will often be forced to forego such a location and take his chances where the natural conditions are not so favorable. If possible, the site should be elevated above its immediate surroundings, thus giving a free circulation of air; and it will also be of great aid in guarding against late spring frosts, so fatal to young fruit at the blooming season.

SOILS.

Apple trees will thrive and do well on almost any soil well prepared, but the different kinds of soil may require different treatment and after care.

Loamy Soil.—A loamy soil is naturally rich in plant food, hence will need little, if any, manuring in its preparation. But it should be deeply stirred and thoroughly broken up by subsoiling. This loamy soil is what may be termed free soil, as it seldom becomes compacted, even by abusive treatment.

Clay Soil.—A clay soil is the most difficult to prepare, and often requires manuring as well as thorough plowing, replowing, and subsoiling. It should be also frequently stirred during the summer months, and especially as soon after each rainfall as is practical, to prevent it from baking and becoming compacted. This becomes even more important in seasons of long and continued droughts.

Sandy Soil.—Sandy soils are generally lacking in necessary plant food. They also have the objection of losing such fertilizers as may be added by the leaching of the rainfall.

Effects of Several Soils.—The wood growth on loamy soils will be strong and vigorous, but may not be sufficiently mature to withstand the freezing of the more rigorous winters. Clay lands are not so apt to produce such vigorous growth, and orchard trees on such lands will be hardier as to winter-killing than are most other soils. With a free subsoil underlying it, a loamy clay soil will probably yield the best results, especially if it be well prepared by thorough culture and subsoiling before planting the trees. Timber lands or lands on which forests have formerly grown, if having the proper exposure and drainage, are preferable for orchard sites. Such lands contain all the

elements of plant food necessary to insure a good and sufficient wood growth and fruitfulness. Fruit grown on such lands will rank first class in size, quantity, and appearance.

DRAINAGE.

All orchard lands should be thoroughly surface drained and sub-drained. No orchard can endure for a great length of time with stagnant water either on the surface or within the soil. All surplus water from excessive rainfall or from other causes should be promptly removed by either surface or subdrainage.

If the natural formation of the land does not afford such prompt drainage it must be provided artificially. Surface ditches or furrows between the rows of trees may afford temporary drainage, but they are objectionable on other accounts that will be apparent; for an orchard thus drained will be bad to get over in its necessary care and in gathering and handling the fruit. Subdrainage is far better on these accounts; besides, it is much more thorough, especially if supplied with well-laid tile.

A thorough breaking up of the subsoil will afford temporary drainage in a stiff clay soil, but in a few years the soil will again become compacted, when it will require restirring. But in all cases the planter should be the judge of the special requirements of his soil and location as to drainage, etc.

USE OF FERTILIZERS AND OF CLOVER.

The soil constituting the proposed orchard site should be carefully studied, and if found to be lacking in essential elements of fertility naturally to maintain a fairly vigorous wood growth, fertilizers should be added before plowing, that they may become thoroughly incorporated with the soil in preparing the land for planting.

BARNYARD MANURE AND WOOD ASHES.

Scientists and practical orchardists are generally agreed on the great value of well rotted barnyard manure as the best for an apple orchard. It not only supplies humus, but it contains a large per cent of other necessary nutritive elements for maintaining health, vigor, and fruitfulness of tree and development of qualities for a fine fruit product. But as the stock of this sort of manure is not always sufficient for the general demand, other agents have to be resorted to; and next in value and in a concentrated form are unleached wood ashes, which will supply to a great extent the necessary element of plant growth. It is maintained by some authorities that 1 ton of unleached wood ashes contains as much plant nutriment as 5 tons of ordinary barn manure, and whenever obtainable ashes should be used in preference to any other fertilizer.

MANUFACTURED FERTILIZERS.

There are many kinds of manufactured fertilizers, some of which are valuable for special soils, but to determine just which brand to use is a difficult question to decide without knowing what elements are lacking in the soil. The three elements most commonly deficient in soil are nitrogen, potash, and phosphoric acid, and chemical fertilizers that contain the largest per cent of these substances will be the most economical and beneficial.

A fertilizer containing $1\frac{1}{2}$ to 2 per cent of nitrogen, 4 to 9 per cent of available phosphoric acid, 10 to 12 per cent of potash, will give excellent results when applied to orchard land in quantity ranging from 400 to 600 pounds per acre.

GROWING OF CLOVERS.

Western prairie lands are generally sufficiently fertile for an orchard growth, and need no enriching until the trees begin to show signs of weakness in vigor from crop bearing, and even then may be invigorated by use of crops of red or crimson clover grown among the trees, allowing the crop to fall and decay upon the ground each year. By this treatment a large amount of decaying vegetable matter will accumulate upon the land, rich in plant food and forming a moist protection from hot summer sun and deep freezing during winter, a condition conducive to health and vigor in tree. All lands lacking in humus can have this element restored to a great extent by such treatment, and orchards which have been treated thus with red clover maintain greater longevity, fruitfulness, and greater excellence in fruit product, besides such treatment dispenses with the costly necessity of using special fertilizers.

SIGN OF NEED OF MANURE AND CULTIVATION.

As to the indications when a bearing orchard needs stimulating, the eminent pomologist, Dr. Warder, once said: "When the growth of the terminal branches fails to make an annual extension of at least 1 foot in length, the tree should be stimulated by manuring the land and giving it thorough cultivation."

PREPARING THE LAND FOR PLANTING.

The general work of preparing the land for planting an orchard consists in deep tilth, and the more thoroughly it is done the more certain is success. The preparation had best be done late in the fall, when it will be ready for early spring planting or for fall planting, if preferred. Many successful orchardists, especially in the Western States, prepare the land by opening with a heavy plow a furrow

where the rows of trees are to be set and then back furrowing the space between them, making a land section with a tree row in the center.

This method affords a deeper tilth under the trees, and at the same time surface drainage into the opening and finishing furrow midway between the rows, which will receive and, if properly graded, carry off any surplus water which may accumulate from heavy rainfalls.

DISTANCES FOR PLANTING.

A decision as to the proper distance apart to set trees varies with different plantings. Some plant 16 by 32 feet—that is, the rows one way are 32 feet apart. The object of this method is to obtain a crop from the trees until they begin to interfere with each other, when every alternate tree in the row is cut out, leaving the trees in the entire orchard at a distance of 32 feet each way. The trees to be cut out should be early-bearing, short-lived varieties. This system has the advantage of utilizing the land between the rows, which becomes a source of great fruit product before the thinning out becomes necessary.

Other planters adopt a distance between trees of 20, 24, and 30 feet apart each way, claiming that by the time the trees interfere with each other they will have finished their growth and the orchard will begin to decline. But it is generally conceded that 32 to 40 feet is the preferred standard distance. If the distance of 40 feet each way is adopted, it will afford ample space between the rows for growing any crop which requires cultivation, such as corn, beans, potatoes, etc. Such cultivation is highly important and necessary for the maintenance of moisture in the soil and to the health and vigor of the trees. This distance will afford free circulation of air and abundance of sunlight, both of which are essential to the growing of well-developed and highly-colored fruit. As stated elsewhere, small grain should never be grown among fruit trees, especially when the orchard is young.

SEASON FOR PLANTING.

This question is governed somewhat by latitudes. In southern latitudes late fall or the early part of the winter may be safe for planting. But in most of the States early spring is considered the better time. Fall planting has the objection against it that the roots of a tree do not take hold of the ground sufficiently to supply enough moisture to maintain a healthy active circulation of the sap which is required to prevent shriveling of the branches during winter's extreme cold and exhaustive evaporation from drying winds.

SELECTION OF TREES.

This is a very important part of orcharding, for upon care and judgment in the selection of trees depend largely future profits of the investment. Strong, stocky, and vigorous 1 or 2 year old trees, called

whips by nurserymen, having well developed root systems, are preferable. Trees of this type and age are more satisfactory and profitable in time and suffer less in transplanting, cost less, and are much more easily handled than older ones.

In this connection we would suggest the advisability of purchasing trees for planting from the nearest responsible nurserymen. The local nurseryman, if perfectly familiar with his business, will understand the needs and demands of his home customers and should grow the varieties best suited to his section of country. If honest he should feel himself morally if not legally responsible for the correctness of his nomenclature. By securing trees at the near-by nursery all danger from damage by long transit and injurious effects of sunshine and frost are avoided; besides, if the farmer makes his purchase direct from the nurseryman, he will save expense of middleman or agent, and is less liable to the mistakes and injury that may occur through repeated handling.

VARIETIES.

Owing to the greatly diversified soil and climatic conditions that exist throughout the territory of the United States, it would not be safe to attempt to give more than general advice on the subject of varieties to plant. Among the very extended list of cultivated varieties of merit, there are few, if any, sections where the apple will grow that varieties may not be found that will give satisfaction if they have a fair trial. But it is a well-known fact that but few of these can be safely recommended for a special locality. There are certain varieties that have a wider range of adaptability than others. Instances of this character may be found in the Ben Davis variety, which has a wide range of adaptability, while the success of the Yellow Newtown or Albemarle is confined to a few localities.

Then, again, a variety may succeed in widely separated regions, while in the intervening sections it may be an entire failure. This fact is well established in the case of the Yellow Newtown, that reaches its highest state of perfection in certain sections of the Pacific coast fruit regions and in the Piedmont sections of Virginia and North Carolina, while in most of the widely diversified but intervening territory it is nearly worthless.

Local conditions as affecting choice of varieties.—With these facts before the reader he will readily see how unwise it would be to attempt to offer in this connection other than general advice on the subject. A comparatively safe guide for the planter to follow or to be governed by is to study well his immediate environs and to take counsel of those of his neighbors who have had practical experience in growing varieties on soils and exposures quite similar to his own. In this way he may be able to obtain valuable information in regard to varieties that have been tested and found to succeed in his neighborhood.

Present demand as affecting choice of varieties.—In the pioneer days of fruit culture, especially in the Mississippi Valley section of our country, the great aim and object of the enterprising planter seem to have been to secure and plant all of the numerous varieties within his reach without considering the question of adaptability of the variety to the conditions of soil and climate. For a time at least, while the soil was new and diseases and insects less numerous, his efforts gave fairly satisfactory results. Now, however, conditions have changed and many of the sorts that were once popular and profitable are considered valueless. So that, notwithstanding the list of desirable varieties is greatly increased, growers find themselves compelled to study more carefully the adaptability of the varieties suited to their special conditions and purposes.

Use of Department Bulletin in making selection.—It is from these causes that the carefully prepared list of fruits, as revised by the American Pomological Society and the Division of Pomology, and published by the United States Department of Agriculture as Bulletin No. 8, may be recommended to the planter as a comparatively safe guide in the selection of varieties. In this the country is divided into districts in which certain varieties are found to be more or less especially adapted. While this may not be followed as an infallible guide, it is made up largely from the practical tests that have been given such varieties within the several sections and districts into which the country is subdivided.

Need of succession as affecting selection.—In making up a list of varieties for a family orchard, it is highly important to select such as will ripen in succession, so as to furnish the family with fruit throughout the entire year. This can be readily done by planting the early-ripening sorts, followed by late summer, fall, and long-keeping winter varieties.

LISTS OF VARIETIES SUITED TO LARGE AREAS.

As many of our desirable varieties are extremely local in their range of adaptability, it will not be possible to present a selected list that will be adapted to all sections of the country. Therefore it is our aim in making up the following lists to include only those of known merit and to divide the country into districts, or large areas, in which the conditions of soil, climate, latitude, elevation, etc., are more or less adapted to the varieties named in the several lists. From these lists the planter may select such as are adapted to his own locality, bearing in mind the fact that there are others within his reach that may be profitably added to those here named. In the choice of varieties the planter should keep in mind the advice already given in this bulletin, to be governed largely by the results and experiences of those who have preceded him in his immediate vicinity. Two or three trees of each of the earlier ripening

varieties will afford sufficient fruit for any ordinary sized family. Should the farmer desire to plant, in addition to his family orchard, varieties suitable for commercial purposes, such are designated in these lists by an asterisk; thus, *Baldwin.

The arrangement of the following lists is approximately in the order of ripening:

FOR THE NEW ENGLAND STATES, NEW YORK, PENNSYLVANIA, NORTHERN NEW JERSEY, NORTHERN INDIANA, AND MICHIGAN.

For this district the following varieties are suggested:

Tetofsky	* Baldwin
Early Harvest	* Ben Davis
* Oldenburg	Wine
Golden Sweet	* Rhode Island Greening
Red Stripe	Winesap
Early Strawberry	* York Imperial
* Maiden Blush	Lansingburg
Yellow Transparent	Fall Pippin
* Red Astrachan	Porter
Trenton Early	Mother
Early Joe	Shiawassee
Benoni	Jersey Sweet
Primate	Wealthy
Longfield	* Grimes Golden
Fall Wine	* Jonathan
Rambo	Smokehouse
Gravenstein	Westfield
Fameuse	Newtown Spitzenburg
St. Lawrence	Red Canada
Jefferis	Domine
Bailey Sweet	* Tompkins King
Melon	Hubbardston
Jacobs Sweet	Romensten
Wagener	Roxbury
* Northern Spy	* Stark
Esopus	* Yellow Newtown. ¹
Rome Beauty	

FOR DELAWARE, MARYLAND, VIRGINIA, WEST VIRGINIA, SOUTHERN OHIO, SOUTHERN INDIANA, KENTUCKY, TENNESSEE, AND NORTH CAROLINA.

For this district the following varieties are suggested:

Yellow Transparent	Red June
Trenton Early	Golden Sweet
* Oldenburg	Red Stripe
Early Joe	Early Strawberry
Benoni	Fall Wine
Primate	Fall Pippin

¹ The Yellow Newtown (*Albemarle*) in any region succeeds only in a few localities where the favorable conditions of soil and climate exist.

Jefferis	Porter
Horse	St. Lawrence
Rambo	Shiawassee
* Gravenstein	Melon
Wealthy	* Grimes Golden
Jacobs Sweet	Newtown Spitzenburg
* Jonathan	Fallawater
* Northern Spy	* White Pippin
Esopus	Arkansas (Mammoth Blacktwig)
Blue Pearmain	* Stark
* Ben Davis	Carter Blue
McAfee	* York Imperial
Ralls <i>Genet</i>	* Stayman <i>Winesap</i>
Bonum	Winesap
Buckingham	Shockley
Yates	* Yellow Newtown.
Early Harvest	

**FOR SOUTH CAROLINA, NORTHERN FLORIDA, GEORGIA,
ALABAMA, MISSISSIPPI, LOUISIANA, AND TEXAS.**

For this district the following varieties are suggested:

* Yellow Transparent	Red June
* Red Astrachan	Yellow June
Early Harvest	* Oldenburg
Summer Queen	Summer Pearmain
Horse	Fall Pippin
Taunton	Kinnard
* Ben Davis	* Hoover
Watson	* Winesap
Bonum	Yates.
Shockley	

**FOR NORTHERN ILLINOIS, WISCONSIN, MINNESOTA, IOWA, AND
NEBRASKA.**

For this district the following varieties are suggested:

Tetofsky	Yellow Transparent
Red Astrachan	Early Joe
* Oldenburg	Early Harvest
Red Stripe	Red June
Golden Sweet	Hightop Sweet
* Benoni	Primate
Charlamoff	Jefferis
Borovinka	Gravenstein
Longfield	Fall Wine
Porter	Fall Pippin
* Maiden Blush	St. Lawrence
Quince, <i>Cole</i>	Ramsdell
Alexander	Wolf River
Dyer	* Wealthy
Rambo	Mother
Lowell	Fameuse
Shiawassee	McIntosh
Peter	Gideon
Melon	Ladies Sweet

*Grimes Golden	*Jonathan
Westfield	*Hubbardston
Newtown Spitzenburg	Wagener
Esopus	Red Canada
Domine	Minkler
Romanstem	Tolman
*White Pippin	English Russet
Rome Beauty	Patten
McMahon	N. W. Greening
*Stark	*Winesap
Ralls <i>Genet</i>	*York Imperial
*Willow	Lansingburg.

FOR SOUTHERN ILLINOIS, MISSOURI, KANSAS, OKLAHOMA, AND INDIAN TERRITORY.

For this district the following varieties are suggested:

Red Astrachan,	Yellow Transparent,
Early Harvest,	Trenton Early,
Early Pennock,	Red June,
Summer Rose,	Early Strawberry,
Yellow June,	Golden Russet,
*Oldenburg,	Benoni,
Maiden Blush,	Summer Pearmain,
Porter,	Wealthy,
Jefferis,	Fall Wine,
Buckingham,	Melon,
Bailey Sweet,	Rambo,
Fulton,	*Jonathan,
*Grimes Golden,	Huntsman,
*Missouri,	Arkansas,
Rome Beauty,	Beach,
Ohio Pippin,	Collins,
*Ben Davis,	Oliver,
Clayton,	Paragon,
Gano,	Shockley,
Stark,	Ralls <i>Genet</i> ,
*White Pippin,	Stayman <i>Winesap</i> ,
Gilpin,	*York Imperial,
*Winesap,	McAfee.

FOR NORTH AND SOUTH DAKOTA, WYOMING, AND MONTANA.

For this district the following varieties are suggested:

*Oldenburg,	*Northwestern Greening,
Tetofsky,	*Yellow Transparent,
Hibernal,	*Wealthy,
Pewaukee,	Longfield,
English Russet,	Plum Cider,
Wolf River,	Peter,
Charlamoff,	Borovinka,
Gideon,	Okabena,
Antonovka,	*Fameuse,
Utter,	*Patten.
St. Lawrence,	

FOR COLORADO, UTAH, NEVADA, AND NEW MEXICO.

For this district the following varieties are suggested:

Tetofsky,	Yellow Transparent,
Colton,	Early Harvest,
* Red Astrachan,	Red June,
* Oldenburg,	Porter,
* Maiden Blush,	Gravenstein,
Alexander,	Wealthy,
Bailey Sweet,	Wolf River,
* Jonathan,	* Grimes Golden,
Newtown Spitzenburg,	Northern Spy,
Pewaukee,	Tolman Sweet,
McMahon,	* Missouri,
Swaar,	* Tompkins King,
Fallawater,	Esopus,
Hubbardston,	Red Canada,
White Pearmain,	Rhode Island Greening,
Yellow Bellflower,	* Rome Beauty,
Domine,	Wagner,
Golden Russet,	White Pippin,
Roxbury,	Limbright,
Peck Pleasant,	Ralls <i>Genet</i> ,
* Winesap,	* Yellow Newton.

FOR IDAHO, OREGON, AND WASHINGTON.

For this district the following varieties are suggested:

Tetofsky,	Early Harvest,
Yellow Transparent,	* Oldenburg,
Red Astrachan,	Red June,
Gravenstein,	* Maiden Blush,
Wealthy,	Fall Pippin,
Wolf River,	Fameuse,
* Grimes Golden,	* Jonathan,
Pewaukee,	Newtown Spitzenburg,
Tolman,	Yellow Bellflower,
* Rome Beauty,	White Pippin,
Red Canada,	Hubbardston,
* Rhode Island <i>Greening</i> ,	* Baldwin,
* Missouri Pippin,	Ralls <i>Genet</i> ,
Westfield,	Wagner,
Golden Russet,	Roxbury,
* White Pearmain,	* Tompkins King,
* Winesap,	* Yellow Newtown.

FOR CALIFORNIA AND ARIZONA.

For this district the following varieties are suggested:

Early Harvest,	Yellow Transparent,
Early Strawberry,	* Red Astrachan,
Red June,	* Oldenburg,
Summer Pearmain,	Gravenstein,
* Maiden Blush,	Porter,

Fall Pippin,	Wealthy,
Fameuse,	Alexander,
Rambo,	Wolf River,
* Grimes Golden,	* Jonathan,
Newtown Spitzenberg,	* Esopus Spitzenberg,
* Tompkins King,	Tolman,
* Yellow Bellflower,	Hubbardston,
Red Canada,	White Pippin,
Rhode Island,	Blue Pearmain,
Swaar,	* Stark,
Wagener,	* Rome Beauty,
* Missouri Pippin,	* Northern Spy,
White Pearmain,	Ralls <i>Genet</i> ,
Hoover,	* Winesap,
* York Imperial,	* Yellow Newtown.

PLANTING.

The land having been prepared by plowing, and manured when needed, the lines to guide the planter may be marked off with a plow run deeply, opening a furrow in the direction that will afford drainage, into which the trees may be set without digging holes, especially if in clay land, which would form basins that would retain water too long after a heavy rainfall.

DETAILS OF SETTING THE YOUNG TREES.

The work of planting is made comparatively easy by the method recommended in the foregoing, viz, by the opening of a furrow with a plow for the rows, and cross-checking to indicate the point at which to set the trees. When planting cut back the top (fig. 5) to a point where the future head is to be formed, smooth off the ends of all the bruised and broken roots, then set, at the point in the row indicated by the cross-check, straighten the roots out into a natural position, and fill in among them firmly fine dirt and tramp all down with the foot. It is best to set the tree a little deeper than when in the nursery, and leaning slightly to the south or southwest,

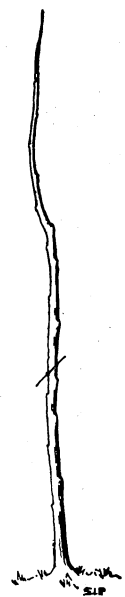


FIG. 5.—One-year-old tree with line to show where to cut back.

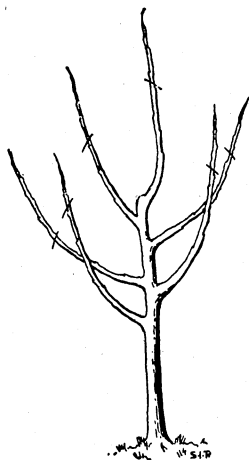


FIG. 6.—Two-year-old tree with lines to show where to cut back.

to brace them against prevailing winds. By this position the tops will soon shade and protect the bodies from the intense heat of the summer sun, which is liable to cause sun scald. After the planting of the orchard is com-

pleted the open furrows between the trees may be filled up by plowing one or more furrows against the row. The second year the young shoots must usually be cut back again. (See fig. 6.)

LOSSES BY LACK OF CARE.

In connection with this subject it is desired to lay special stress upon the importance of performing all operations of the management and care of an orchard in a painstaking way. It is worse than time and money squandered to purchase trees, transplant them, and then neglect them afterwards in such manner as to lose them entirely, and yet this is the result in a very large majority of cases. It has been estimated that scarcely more than 10 per cent of the trees that are grown and sold by nurserymen survive the after ordeal to which they are subjected before reaching the bearing age. And this great loss is very largely the result of carelessness and neglect of the planters. The farmer who does not propose to give the same careful treatment to his orchard that he does to his other crops had better not make the effort to have one. If he expects to sow his young trees to grass or small grain and then to graze it with calves or other live stock he will find other and cheaper methods of occupying his land and feeding his stock than by investing in trees. Better save his money and pains and wisely decide in advance to go without an orchard.

CULTURE.

Thorough and oft repeated stirring of the soil is absolutely essential to success. Such culture as is needed to produce a first-class crop of corn or potatoes will keep an orchard in good health and vigor, provided the ground is sufficiently fertile. As already stated, in no case should small grain or grass be grown in an orchard. This mistake is often made by thoughtless or inexperienced planters.

The ground having been properly prepared before planting, a two-horse cultivator frequently run between the rows will keep it in good condition during growing season. Each spring the surface should be well stirred with a two-horse plow, using a short singletree next to the row of trees to avoid danger of bruising the trunks of the trees. In plowing, the furrows should be alternately turned toward and from the trees. Such culture should be continued from year to year at least until trees come into full fruiting, and even then it is questionable whether it should be discontinued. If it should be, red or crimson clover is the only crop allowable, and that should be turned under as often as once in every two years. As a rule, continuous cultivation gives the most satisfactory results.

PRUNING AND TRAINING.

Pruning and training are requisites in the successful management of an apple orchard. The objects to be attained are: First, symmetrical and evenly balanced heads; second, to admit sunlight and free circulation of air into all parts of the tree top and yet maintain sufficient density of foliage to protect the trunks, branches, and fruit from

the direct intense heat of the sun's rays, which is liable to scald and injure both tree and fruit.

Training should begin in the nursery row by removing or preventing all unnecessary growth, which may be done by rubbing off the buds or pinching back with thumb nail the tender shoots with a view to form a straight, clean leader from the ground up, from which to form the future trunk.

SHAPING THE TREE.

As recommended under the head of planting, this single stem, if it has attained a sufficient growth, should be cut back at the age of one or two years to the height from the ground it is proposed to form the head of the tree when set in the orchard. This cutting back will cause several of the upper buds to break and grow,

thus starting the top or head at proper height; and these should be watched, and only such left to grow as are to form the main branches. Those left should be the strongest shoots, at equal distances apart around the stem, and should tend to an outward growth—to spread and make an open head.

In all pruning to give the desired form to the head, and especially while the tree is young, the orchardist should keep clearly fixed in his mind the future form of tree—that is, what it should be when old; for what may seem an open head when young may prove, when the trees are older, to be too dense and crowded, the branches too closely formed

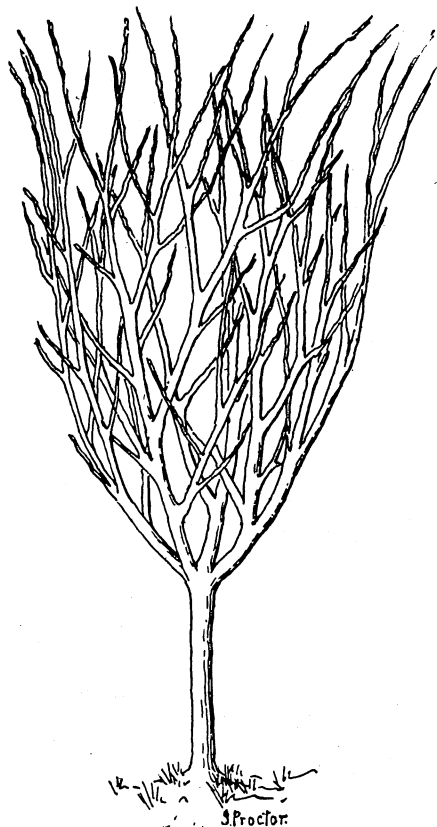


FIG. 7.—Vase form of top.

together for convenience in getting around it in gathering the fruit or in giving necessary pruning.

During early springtime, or even late winter for convenience, when the wood is not frozen each year, every tree should be carefully looked over, and all branches which are liable to interfere with adjoining ones should be cut out and the centers of the dense growth thinned out, side branches which are making a stronger growth than the others should be checked by heading in the terminal or central shoots, and all parts of the tree should be cut back whenever needed to maintain an evenly balanced head. Some varieties have an upright habit of growth and some make slender growth; such need close attention each year in cutting back one-half of last year's wood growth, leaving the top bud on the side of the branch facing the direction to which it is intended to divert the growth. By this treatment there will be no difficulty in shaping the tree into any desired form. Open spaces in the tree may be closed up; as, for instance, when the tree has been deprived of a necessary branch by accident or otherwise, the loss may be recovered in time by pruning

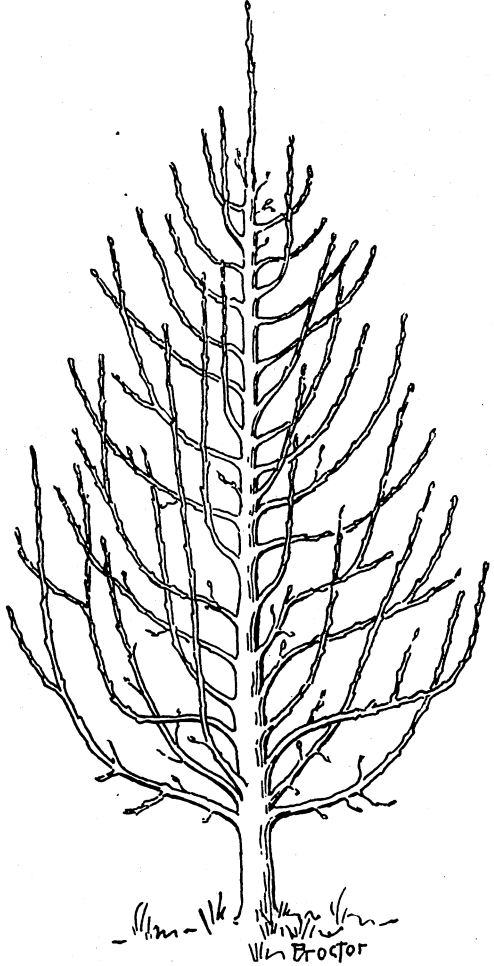


FIG. 8.—Pyramidal form of top.

ing the adjoining branches so as to divert the growth into the portion made bare of branches.

All pruning and training possible should be done while the trees are young, the growth of wood tender, as the healing over is more rapid and complete and the tree suffers less injury by the operation. If ever it becomes necessary to remove a large branch, the wound should be covered with grafting wax, paint, or some other substance that will

prevent evaporation and the wood from checking and consequent decay.

Height of Top.—There is a diversity of opinion among orchardists as to the proper height at which to form the top or head of an apple tree. Formerly from 4 to 5 feet high was the common practice of training apple trees, but 2 to 3 feet is now conceded to be preferable.

The objection to low-headed trees on account of the difficulty in cultivating the land has been overcome by practical experience. A careful teamster will do less damage to a low-headed tree than to one with high top. With the improved implements now in use thorough tillage can be performed as well among low-headed trees as with higher. There is less danger from high winds with the low heads, and pruning can be performed with greater facility and ease, and the saving in expense of gathering the fruit is quite an item; but the more important

advantage gained by the low head is the protection of the body of the tree from the rays of the sun, causing what is known as sun scald, which is very prevalent in some sections of the apple-growing region.

Another point gained by the low head is in conservation of moisture and lower temperature around the base of the tree.

No arbitrary rule, however, should be laid down as to the height of a fruit tree. This may depend upon the locality, exposure, variety, and the desire of the planter.

Some varieties have an upright habit of growth, while

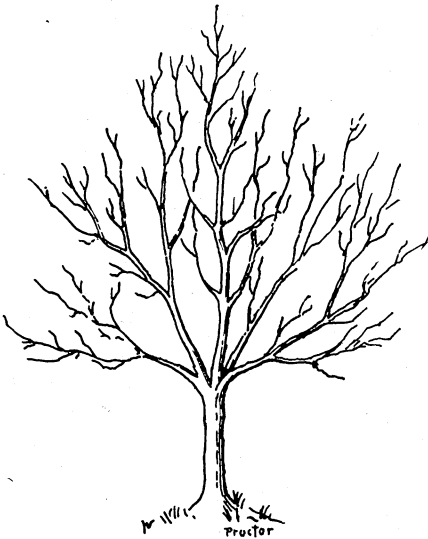


FIG. 9.—Intermediate form of tree; proper shape.

others have a drooping or horizontal habit, each requiring a training according to its requirements; but whatever difference of opinion there may be on this subject, it is now generally conceded that the low top, all things considered, is preferable.

Form of Top.—There are three forms that are generally adopted in this country. One known as the vase or goblet form. This form prevails to a large extent in the Pacific coast region, where by long experience it has been found to be best suited to the conditions of that section. This form is obtained by cutting out the central stock or leader and training by a system of pruning into the shape shown in figure 7.

The pyramidal form is the opposite of the vase form in that the

main stock or leading shoot of the tree is allowed to maintain its upright growth and the side branches are shortened back so as to produce the form of a pyramid, as shown in figure 8. There is, however, a modified form between the vase and the pyramid which gives a round, symmetrical shape to the tree (fig. 9) sufficiently open to allow of free circulation of air and sunlight. This form is more generally adopted and gives better satisfaction throughout the central and eastern apple-growing regions.

PROTECTION FROM MICE AND RABBITS.

These animals wherever they exist are liable to do much damage to young trees during the winter months, especially whenever the ground is covered with snow. Anything that affords protection to mice, such as grass, weeds, or leaves, should be removed from around the trunks of trees.

It is only when the natural food of the rabbit is cut off by being covered with snow that this destructive little animal is forced to resort to gnawing the bark from fruit trees. To prevent this pest from doing this damage, many methods have been devised; but the most effective plan is to tie some material around the body of the tree to the height of 2 feet or more. Cornstalks cut to the desired length are the most available material for the farmer to use, and serve the purpose very well. Building paper, plain or tarred, is effective, and even old newspapers tied around the trees have been found to serve the purpose just as well. Every farmer should see to it that some such protection is given his young orchard before winter sets in, else he may find too late that his trees have been girdled and ruined by these mischievous animals.

GATHERING THE CROP.

After supplying the family with all the apples needed from the family orchard there is generally a demand in our markets for all surplus from the time of the earliest ripening throughout the year, and for this reason the farmer should know how to handle this surplus to the best advantage.

The proper stage of maturity at which it is best to take the fruit from the tree, if for market, will be governed somewhat by the distance to the market to be supplied. If near by, and requiring no shipping, the fruit may be left on the tree until nearly mellow, which is the best condition for summer and fall varieties for dessert purposes. But if to be shipped a long distance it should be picked as soon as the seeds are fully matured. Winter sorts may be allowed to remain on the tree as late in the fall as will be safe against freezing, but if any varieties should commence to drop from the tree they should be gathered at once.

No specific date for gathering can be given, because of variation in climate with latitude. The orchardist must determine the proper time, judging from the condition of the fruit. Fruit for any season of the year should be carefully picked and the stem not broken, avoiding bruising or breaking of the skin. No strain should be made on the stem at its juncture with the apple, as is likely to occur by jerking it from the tree; for decay is liable to set in at its base. Grasping an apple with the hand, placing the thumb at the tip of its stem for a fulcrum, and suddenly giving it a turn over the thumb will separate it from the branch without injury.

At the time of gathering summer and autumn-ripening sorts they should be assorted and packed into the regular apple crate or box as fast as picked, protected from sun and wind, and sent to market each day. All blemished and undersized fruit should be rejected, as it does

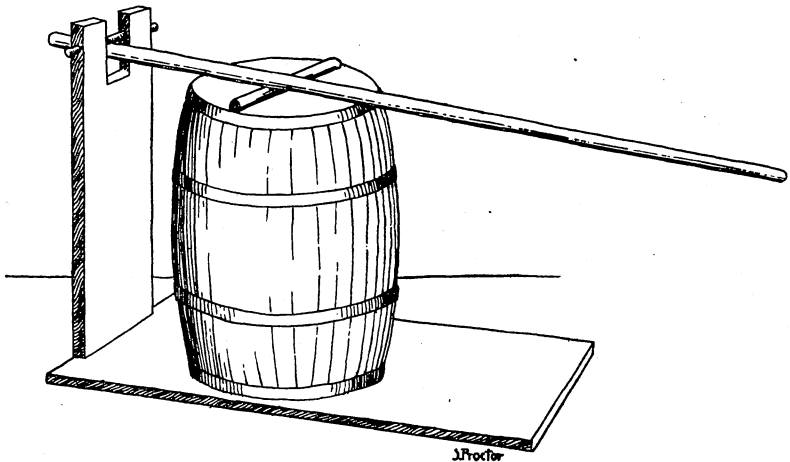


FIG. 10.—Barrel header.

not pay to mix in the crate any damaged by insects or careless handling. No matter how large and fine appearing an apple may be, cast it aside if blemished.

Winter sorts require the same care in picking and assorting. They may be piled up in the orchard under the trees for awhile without danger of injury and assorted and packed in barrels after the gathering is done, but it will be a saving of expense and much better for the fruit to place it at once in open crates or boxes and haul it to a storage room, where it may be put into bins, each variety by itself.

In packing it is the common practice to face the lower end of the barrel with two layers of selected apples. This is what is termed facing, and it is this end that is opened when examined by the buyers. The balance of the barrel is then filled up loosely until about half full, when it is gently but thoroughly shaken down, then the filling is com

pleted, rounding up the barrel more than full, and the head put on and pressed into position by means of lever or screw (fig. 10), hoops being put on and nailed fast. If the apples are properly shaken down while filling the barrel the final pressing and clamping should not injure or mar the last layer of fruit. The safety of the packing consists in firmly compressing the fruit so as to avoid any rattling about; otherwise it will not stand handling without injury. In some sections of the country boxes are used instead of barrels, but the same care is necessary to fill the box full so as to prevent the fruit from rattling about.

DISPOSITION OF THE CROP.

As heretofore stated, the crop of summer and autumn apples requires an immediate disposition, either by sale in the market or by evaporation or manufacturing into cider. If properly picked, assorted, and packed, they will "stand up" for several days, and in the lack of a near-by market may be shipped quite a distance safely. But unless the farmer has a convenient near-by market there will be little profit in growing early perishable varieties.

The crop of winter varieties can be handled more profitably, as it is not so perishable.

The stock of early winter sorts may be held in safe storage for awhile if a paying market can not be found at once, but generally it is best to sell before freezing weather comes on, or as soon as packed, and while the apples are in prime condition. There is no certainty of any gain in holding for any length for an advance market price of any of the winter class of apples, unless the grower has in his own right good facilities for storage; and even then the stock will require reassorting to fit it for market, and often a loss in stock greater than the gain in advanced price occurs through rot or shrinkage. There is, however, and especially when markets are glutted, a chance to gain in market prices by holding the stock of the late-keeping varieties for awhile until the glut is relieved; but whenever a paying market is available, even at small margins of profit, it is the best business economy for the producer to dispose of his crop at once and thus avoid the risk of losses owing to decay and shrinkage, which are liable to occur by holding; also the probable additional expense of reassorting. There may be seasons, of course, when a known shortage in the general crop will justify holding for advanced prices, but such a condition is exceptional, not general.

SUMMARY.

1. A gentle eastern or northeastern slope, as a rule, is the most desirable for an orchard site, but this may vary in different apple sections.

2. Soils such as are found in timber regions afford the best results, but outside of such districts clayey loam having free surface and sub-soil drainage are best.

3. Well-rotted barnyard manure is the most valuable for apple orchards. The next best fertilizer is crops of red clover grown among trees and allowed to fall and rot on the ground or frequently turned under and reseeded.

4. Thorough surface tilth is required to obtain best results in the orchard, and when needing fertility the land should be properly manured before plowing.

5. Trees are more safely set in early spring. They should be strong, vigorous, 1 or 2 years old, having a well-developed root system, and at time of setting their tops should be cut back to the height at which the main branches for the future top is to be formed. All broken and mutilated roots should be cut back to sound wood. For easy planting open out a deep furrow with a 2-horse plow along the line where the rows are to be made and cross check at the distance apart at which the trees are to stand. At the crosses level off the ground at the bottom of the furrow to receive the tree with its roots in natural position and fill in the dirt among them well and tramp down, leaning the tree slightly to the southwest.

6. Thorough tillage with a cultivator during the growing season is recommended, and plowing the land each spring, turning it each alternate year toward the trees.

7. Prune each year in early spring before growth starts, removing all cross branches, and thinning out where too densely grown, so as to balance the tops and afford free air circulation and admit sunlight to all parts of the tree.

8. All classes, summer, autumn, and winter apples, must be carefully picked without loosening the stems from the fruit; handled carefully to avoid bruises or breakage of skin, and placed under protection from sun and wind until final disposition is made of them. Apples for home use should be stored in some place where the temperature should be kept as low as possible without danger of frost.

9. Summer and autumn sorts, if for market, require an immediate disposition, as they are quickly perishable. Winter varieties may be held for a while during a glut in the market and in seasons of a shortage generally. At other times it is a question of good business policy for the producer to consider well the best way of disposing of his crop.